

RAINFALL AND DRAINAGE OPERATIONS

551.578.1

By E. V. WILLARD, Commissioner of Drainage and Waters, Minnesota

The Weather Bureau is occasionally asked as to the effect of the drainage of marshes, sloughs, and small lakes upon the rainfall of the region so drained.

Mr. E. V. Willard, Commissioner of Drainage and Waters, State of Minnesota in an address on February 1, 1924, before the Minnesota Federation of Architectural and Engineering Societies took for his subject "Drainage development in its relation to wild animal and plant life and rainfall."¹

Mr. Willard showed from the rainfall records maintained by the Weather Bureau in Minnesota both before and after drainage operations were begun that the rainfall of the second period was slightly greater than that of the first. His findings are so closely in accord with those that would be reached from a consideration of the

physical features of the problem that they are reproduced in the paragraph below:

* * * But the judicious observer with an orderly mind recognizes that, while the available records conclusively dissipate the charge that reclamation by drainage has caused a reduction of rainfall in Minnesota, he acknowledges the varied and undeterminable influences of the other human activities which may or may not affect climate, and does not seize upon the slight advantage in rainfall during the past 20-year period shown by the comparisons made herein, and credit such increase to the effects of drainage. He knows that drainage has not affected rainfall; that the present-dry cycle is not unlike many others which have come and gone in the past; that no records are being broken; that wet cycles will alternate with dry ones; and that when the leaders of sportsmen's organizations, and those who are so deeply concerned with retaining nature as "God Almighty made it" seize upon drainage as the cause of all disturbing elements, they are either desperately in need of something upon which to make an issue or they are inexcusably ignorant of facts which are easily within their reach.—A. J. H.

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THE CLIMAGRAM

By G. HELLMANN

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In presenting climatological data in my lectures on climatology I have occasionally made use of a device which, if incorporated in a general formula, such as the one given below or in a similar form, would be of great use in many connections. I called it at first a climatic formula, but since in the meantime this expression has been used by W. Köppen to designate a scheme for the description of a climatic province, I prefer to call it a climagram. Its construction is based on the often used principle of the code telegram employed in the telegraphing of weather observations. The order in which the letters are given always follows a stipulated arrangement, so that the addition of further notations among the characters, as for example in this case of the climatic elements, is unnecessary. We are concerned, then, only with the question of deciding what climatic characteristics it is necessary to include in the description and in what order these should appear. I think that the mean values for the year and for the extreme months, for temperature, moisture, cloudiness, and precipitation, together with the average and absolute extremes of temperature, are sufficient.

An example will serve to make this clear:

Climagram of Berlin (32 m.)

9.2 $\frac{18.9}{-0.4}$ $\frac{(33.2)}{(-13.8)}$ $\frac{37.0}{-25.0}$ | 6.9 $\frac{10.8}{4.0}$ 76 $\frac{87}{64}$ | 6.4 $\frac{7.6}{5.7}$ | 582 $\frac{75}{38}$ 169 $\frac{16.2}{12.5}$

It is evident that the first group has to do with temperature; the second with moisture, absolute and relative; the third with cloudiness; the fourth with precipitation, its depth in millimeters and the number of days

of occurrence. Addition of degree signs and per cent signs is superfluous. Moreover, I have placed in parentheses the average temperature extremes (not usually indicated) so that when they are given there is no doubt as to whether one is dealing with the mean extremes or with the absolute extremes. Similarly, if in the case of moisture one of the values is missing, there can be no uncertainty. If it is desired, furthermore, to indicate to what months the extreme monthly means belong, one simply need affix the number of the month in Roman letters. This should be done preferably only when the occurrence fails to coincide with the usual extreme months, namely January and July.

Thus:

Climagram of Rome (36 m.)

15.4 $\frac{21.5}{7.0}$ $\frac{42.0}{-8.2}$ | 9.3 $\frac{13.2}{5.7}$ 65 $\frac{74}{55}$ | 4.4 $\frac{5.5 \text{ III}}{2.0 \text{ VII}}$ | 827 $\frac{127 \text{ X}}{18 \text{ VII}}$ | 99 $\frac{11.5 \text{ XI}}{2.2 \text{ VII}}$

In case one or another of the specifications is not made, no misunderstanding can occur, provided the sequence of the arrangement is rigidly adhered to. The altitude of the station, standing next after its name, is a sufficient indication of its mean atmospheric pressure.

In printing the formulae one should take care that in using small letters for those specifications which are given in fractional form, the height of the row be not [greatly] exceeded.

If the abundant and very useful specifications of climates in Köppen's *Climates of the Earth* were given in the form of climagrams, they would take up considerably less space, and one would not have to search for them in two different tables.